

# Applications Working Group

*Objective:*

Bring together many of the  
other scientific questions and  
approaches to solve problems

## Projects of large extent (grand ideas):

- Create an artificial mineral deposit
- Create an artificial petroleum reservoir
- Construct a water reservoir at the surface to stress the subsurface
  - examine effect of increasing strain

# Projects involving incremental advances:

Applications to mining technologies (and creation of holes in the ground):

- Location of new ore deposits
- Location of new ore deposits in a less invasive manner
- Extraction of ores in an environmentally friendly manner
  - Monitoring of lixiviant transport and fate
  - Hydrofracturing
  - Mitigation of the mined areas at end of extraction

***DUSEL provides a place for testing extraction methods***

# Innovative Applications for Petroleum Technology

## Key is fractured rock

- (1) Image the salt water in the rock from surface using P, S from surface, VSP, reverse VSP, and cross-well surveys
  - Dusel will provide opportunity for mine-back
  - Gain confidence in interpretation and development of new interpretation methodologies
- (2) Pump in fluids, e.g. water, gas, oil
- (3) Produce the fluid with the idea of being imaged to see where residual fluids
- (4) Mine-back must be “*gentle*” to determine how fluids are really distributed

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where residual fluids

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## Specific questions:

- (a) Is the permeability of the rock mass in the same direction as the seismic anisotropy?
- (b) How much better resolution can be achieved by using seismic characterization arrays within the DUSEL facility?
- (c) Can high-frequency, powerful sources (~10 KHz as opposed to present 2 KHz sources) provide significant improvements in interpretation in cross-hole work?
- (d) Could hard rock information be transferred to soft rocks?
  - Fracture orientation issues do not transfer well from hard rock to sediments
  - Could hard rocks be useful at all? reduces effect of matrix porosity (removes a variable)

**Needed:**

**A place to test all possible geophysical  
techniques to validate interpretations**

## ***Why is Dusel important for “Applications”?***

- **Need long-term, consistent access**
  - **Mines will not necessarily allow such access**
  - **Monitoring pillars and strength of the rocks over time requires long-term access to gallery-sized areas**
  - **Lithologic heterogeneity and varying pillar sizes important**
- **Rock burst monitoring can be done better at DUSEL than in operating mines**
  - **Mine-backs very important**
  - **Studies of this sort are not being done anywhere else in the world**
- **Provides a platform for development and testing of novel methods of mine support**
- **A deep, dedicated facility would have intermediate levels - not restricted to operating areas**

## **CARBON SEQUESTRATION**

- Typical use of a reservoir after petroleum production
- DUSEL could help in examination of chemistry of the pore spaces
- Leakage outside of casing in old wells is a serious issues
  - DUSEL could allow examination of possible remediation methods
  - Might be able to mine back to an old well bore

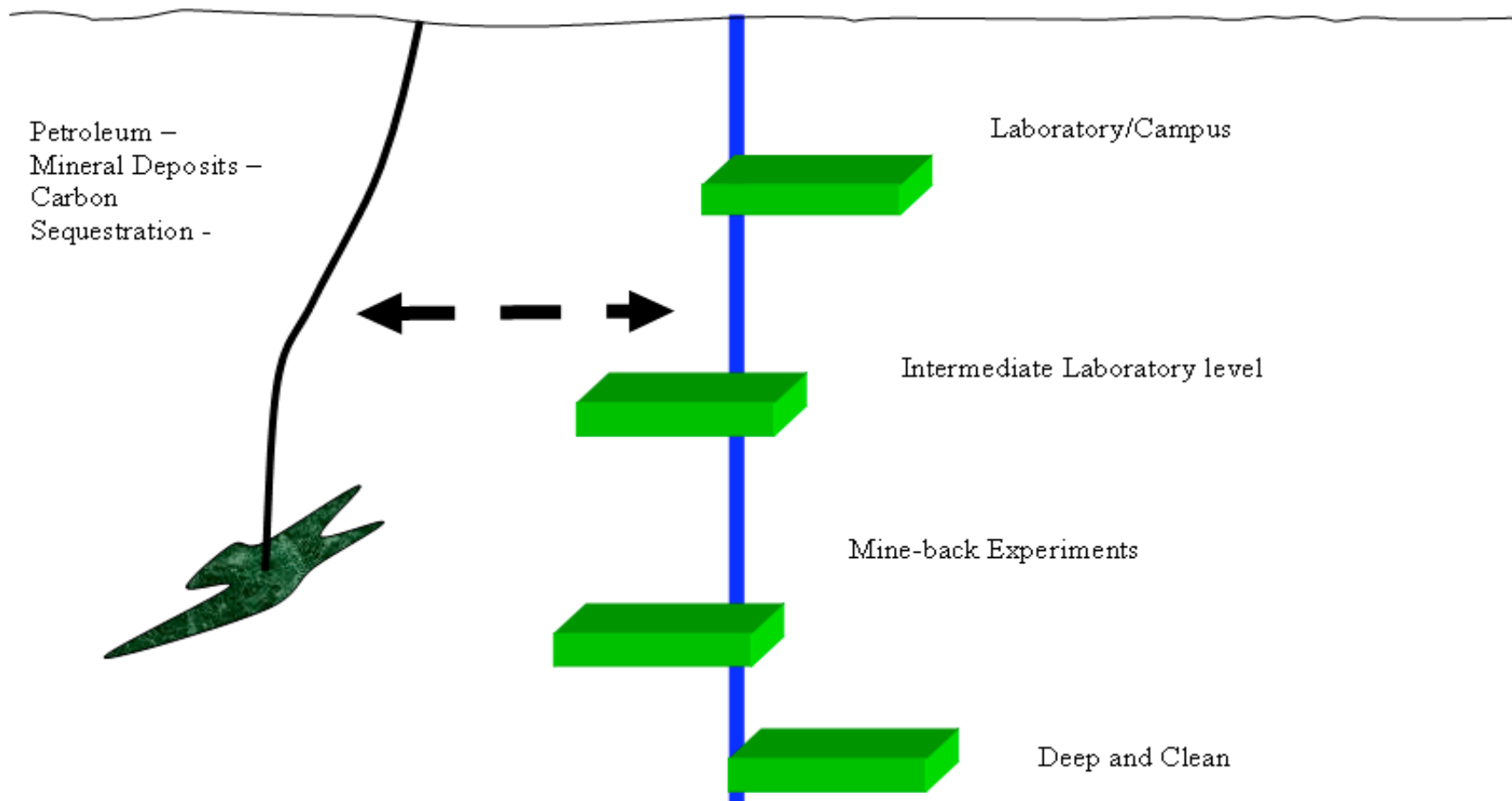
# **Homeland Security**

- **Low background counting**
  - solids, or gases
  - Characterization of slight contamination on materials of interest
  - ultra low level new standards for analytical techniques
- **Construct large vertical loops between shafts**
  - submarine communication (similar to VLF but more effective)
  - could investigate high electrical conductivity layer at 20 - 30 km depth

## **Low noise will also help other disciplines**

- **Biomedical**
  - **Smaller amounts of tracers in people required, therefore, fewer side effects**
  - **Feasibility study of whole body count**
  - **Clean rooms/environments in underground facilities could be used as a control for study of asthmatics**
  - **Comparative studies of effects of radon/low radon living areas**
- **Evaluate mutation rates due to cosmic radiation by comparing biological samples at the surface to similar ones in the bottom of the facility**

- **Underground manufacturing and development**
- Electroforming of copper underground
- Detector fabrication for the physicists
- Reduction of radiation damage in chips for electronics industry
- Development of low-concentration standards for neutron activation (and other nuclear analytical techniques)
- Energy storage by pumped hydro power
  - Increase in height results in less mass needed
  - Build additional cavities for energy storage
  - Evaluate effect of oscillating heads on rock strength



- Education Implications –
  - DUSEL may help to maintain interest in mining applications
  - Dusel may help in training for mining/business enterprises
  - Coal mining remains important although productivity increases decreases number of people involved
  - Remediation requirements may represent the greater need for people in the long term